



REPÚBLICA DE MOÇAMBIQUE

MINISTÉRIO DA INDÚSTRIA E COMÉRCIO

DIRECÇÃO NACIONAL DA INDÚSTRIA

1. Aluminium Smelter

The aluminium smelter pre-feasibility study proposes to produce 554 000 tonnes per annum of saleable aluminium ingots. The core technologies underpinning the smelter are of Chinese origin, of which the SAMI SY300 reduction cell technology is the primary component. The smelter proposed would comprise four pot lines, a cast house and fully integrated anode production facilities. All raw materials for the smelter will be imported, with alumina being supplied from CVRD's refinery in Brazil, and all metal product will be exported. It is proposed in this PFS that the smelter should be located at Beira.

A site between Beira and Dondo is the preferred location for the smelter if it is to be based in the Beira region. As a stand-alone project, a base case IRR of 11,3% is indicated for the smelter. This includes provision for integration of the smelter with the SAPP power grid, and a dedicated wharf facility at the existing port of Beira. A return of 13 – 14% IRR could be expected if key input assumptions on metal price and construction costs are aligned with expectations and forecasts extending to the construction and operating period.

Project risks are reasonable, and can be evaluated in more detail at an early stage of a feasibility study. The key issues to address are identified below:

- Location for the smelter and power station sites;
- Access to the existing port;
- Integration of the smelter and power station with the SAPP grid system;
- Technical due diligence on the Chinese technologies proposed for the project;
- Technology transfer and initial start-up; and

- The other major risk is the resourcing for construction and operation of a mega project in a country with limited resources in terms of skilled labour and social infrastructure. This risk will require experienced management and commitment to nationalisation programmes to achieve successful outcomes.

2. Bio-diesel Plant

The bio-diesel plant pre-feasibility study proposes the production of bio-diesel oil in Mozambique, comprising the planting and production of oilseeds, the extraction of the vegetable oil from them and its further transformation into bio-diesel. The distribution of the product, under a partnership with large diesel wholesalers, has also been studied. The bio-diesel project output capacity is 100 000 metric tonnes per year, equivalent to 117 million litres per year of pure bio-diesel (B100) (1).

The results of the economic, financial and sensitivity analysis of the agricultural industrial bio-diesel project in Mozambique indicate, on a pre-feasibility level, that the enterprise, as described, is technically and economically feasible, profitable, measured by the estimated internal return rate of over 16% p.a. It must be highlighted that this rate does not include any tax incentives or protected prices.

From a market standpoint, this is a very low-risk enterprise, given the fact that Mozambique is 100% dependent on external sources to supply its domestic diesel market, estimated at 400 million litres in 2006. It must be pointed out that irrespective the proportion of the use of bio-diesel in mixtures with diesel, the Mozambican market offers great opportunities for the use of bio-diesel as a substitute for petroleum diesel.

It has been assumed that a major industrial consumer may absorb around 40% of the project output, projected to reach its full capacity of 100 000 tonnes/year (equivalent to 115 million litres/year). The remaining 60% shall be destined for the domestic market, with a growth forecast of 8% p.a., and for the project's own consumption. By the end of year 15, the country shall absorb over 250 million litres of bio-diesel in an average B23 mixture.

Availability of good and fertile land, adequate physical and weather conditions, combined with an abundant rural population have made possible the conception of a seed-producing agricultural project based on the cultivation of the *Jatropha*, with expected rates of effective productivity of 7,8 tonnes of dry seeds per hectare, likely to match those found in South Africa in similar physical conditions.

In summary, notwithstanding the country's natural difficulties in hosting investments of this size, Mozambique has a number of positive conditions which render such a project attractive. These conditions are further described below:

- **Market** - a market for bio-diesel which is still unexplored and of high potential;
- **Physical conditions** - regions with favourable physical conditions for the cultivation of the Jatropha;
- **Lands** - availability of large estates of free land for large agricultural projects; and
- **Rural work force** - an abundant rural population for the maintenance and manual harvest of the Jatropha.

These factors make the implementation of a bio-diesel project in Mozambique attractive.

3. Cement Plant

This pre-feasibility study contemplates a cement plant to be located in Mozambique, for the production of Portland cement using limestone, gypsum and coal ash from a thermal power plant (TPP). The cement project would be located in Moatize, near the 1 500 MW power plant to be installed near the CVRD coal mine. The proposed cement plant's production, initially with an annual capacity of 360 000 tonnes, should ensure market share for future expansions, possibility including the implementation of a full-cycle cement plant.

The internal return rate of (IRR) was verified to be higher than the discount rate calculated, demonstrating that the project may offer attractive profitability. The forecasted IRR of the project is 30,5%; however, the following two factors should be considered:

- First, the construction of a clinker grinding plant rather than an integrated cement plant, given the size of the Mozambican cement market and existing producers, offers a significant reduction in the investment; and
- Second, the use of pozzolanic ash from the power plant to be installed in Moatize, besides the environmental benefits mentioned previously, offers a highly competitive cost structure, given that pozzolanic ash accounts for 40% of the total mass of raw materials input.

4. Charcoal

The charcoal facility pre-feasibility study proposes producing charcoal from timber of quick-growing cultivated forests (eucalyptus) in Mozambique, starting with the creation of tree nurseries (eucalyptus) and planted forests. The charcoal project is intended to supply a future pig iron plant comprising two blast furnaces running on charcoal with output capacity of 360 000 tonnes/year. With the intention of bringing the cultivated eucalyptus forest nearer to the mineral production areas, it is

proposed to concentrate the planted forest areas and the industrial production of charcoal in the vicinity of Honde, in the Manica province.

The analysis in this study indicated technical feasibility for the implementation of a project for eucalyptus forestry and production of charcoal in Mozambique, in the selected areas of Manica province, in the region of Beira. However, the economic feasibility is far below the acceptable level as the project would only present a positive internal return rate of 5,8% p.a.

5. Coking Plant

The coking plant pre-feasibility study investigates the technical, economic and business pre-feasibility for the implementation of a coking plant in Mozambique aimed at taking advantage of the coking coal supply from Moatize to be exploited by RDMZ for export purposes. The proposed industrial facility selected for this study comprises a heat recovery-type coking plant associated with a thermal power plant which will use energy in the form of latent heat from gaseous effluents to generate steam and electricity.

Considering the assumptions detailed in this study, especially the prices of coal, various types of coke and electricity, the project presented insufficient ROI, with negative results until year 12.

A sensitivity analysis undertaken, assuming an increase of 10% in revenues, resulted in a measurable ROI rate of 5,9%, still below the level expected by investors to justify the implementation of the project.

The main factors negatively influencing the project's outcome are the selling prices for the various types of coke. This is further jeopardised by the specifications of the Moatize coal supplied to the coking plant, especially the ash content. The use of the Moatize coking coal with 10,5% ash (dry basis) as the sole feed-stock to a coking plant, can reduce the produced coke price to almost 80% of the price achieved by other coke producers.

Potential problems were also identified in terms of difficulties in establishing partnerships with future buyers of blast furnace coke. This is due to the specifications of the coke, as well as the growing trend amongst consolidated steel mills of ensuring internal coke sources or, when in a consortium with other companies, sources as close as possible to their production units.

6. Ferro-alloy Plant

The ferro-alloy plant pre-feasibility study investigates a plant designed with an installed production capacity of 80 000 tonnes/year of manganese

ferro-alloys, being 46 000 t/y of refined ferro manganese and 34 000 t/y of ferro silicon manganese. The proposed location for the implementation of the project is the Dondo Industrial Park, located approximately 28 km from the Beira District, in the Sofala province.

The preliminary results do not indicate an acceptable minimum level of profitability for the project, with an internal return rate of only 2,7% p.a. Thus, the pre-feasibility analysis performed points to the economic non-feasibility such a project.

Mozambique does not yet have a domestic market for ferro-alloys, which implies the export of 100% of the project's output abroad, and the international market for this commodity is not very favourable in terms of price at present nor in the foreseeable future.

Based on the sensitivity analysis performed, the project, should the assumptions adopted be confirmed, would be feasible only for average FeMnAC and FeSiMn prices projected for the long term, of US\$ 700/t CIF Asia, or higher.

7. Steel Mill

The steel mill pre-feasibility study investigates the feasibility of a project in Mozambique for the production of long rolled steel products, through the milling of imported billets and with an installed capacity to produce 100 000 tonnes/year of rods, bars and light shapes. The proposed location selected for the implementation of the project is the Dondo Industrial Park, located approximately 28 km from the Beira district.

The pre-feasibility study further discusses the rationale of the project together with the study approach, deliverables, implementation plan, cost and finance and risk analysis as well as the overall profitability of the individual studies conducted.

The preliminary results do not indicate a minimum acceptable level of profitability for the project, with the ROI estimated at only 1,6% p.a. Thus, the pre-feasibility analysis carried out points to the economic unfeasibility of the project.

It must be observed that the study did not consider any initiatives from competitors with regard to implementing other plants offering steel long products in the country, nor the refurbishment and re-entry into operation of existing plants (currently inactive).